



Genetic Analysis of Unmarked Juvenile Chinook Salmon in Nearshore Habitats of the San Juan Islands

David Teel, Kurt Fresh, Anna Kagley,
Todd Sandell, Bruce Brown, David Kuligowski, and Eric Beamer

Northwest Fisheries Science Center, NOAA Fisheries
Skagit River System Cooperative

Presentation Outline

- **Brief Background on Methods**

- Genetic Stock Identification (GSI)
- Genetic stock groups in Washington and British Columbia

- **Analyses of San Juan Island Samples**

- Estimates of Stock Proportions
- Comparison of Stock Composition Patterns with other Puget Sound Regions
- San Juan Islands Sub-regional Stock Compositions

GSI Methods Summary

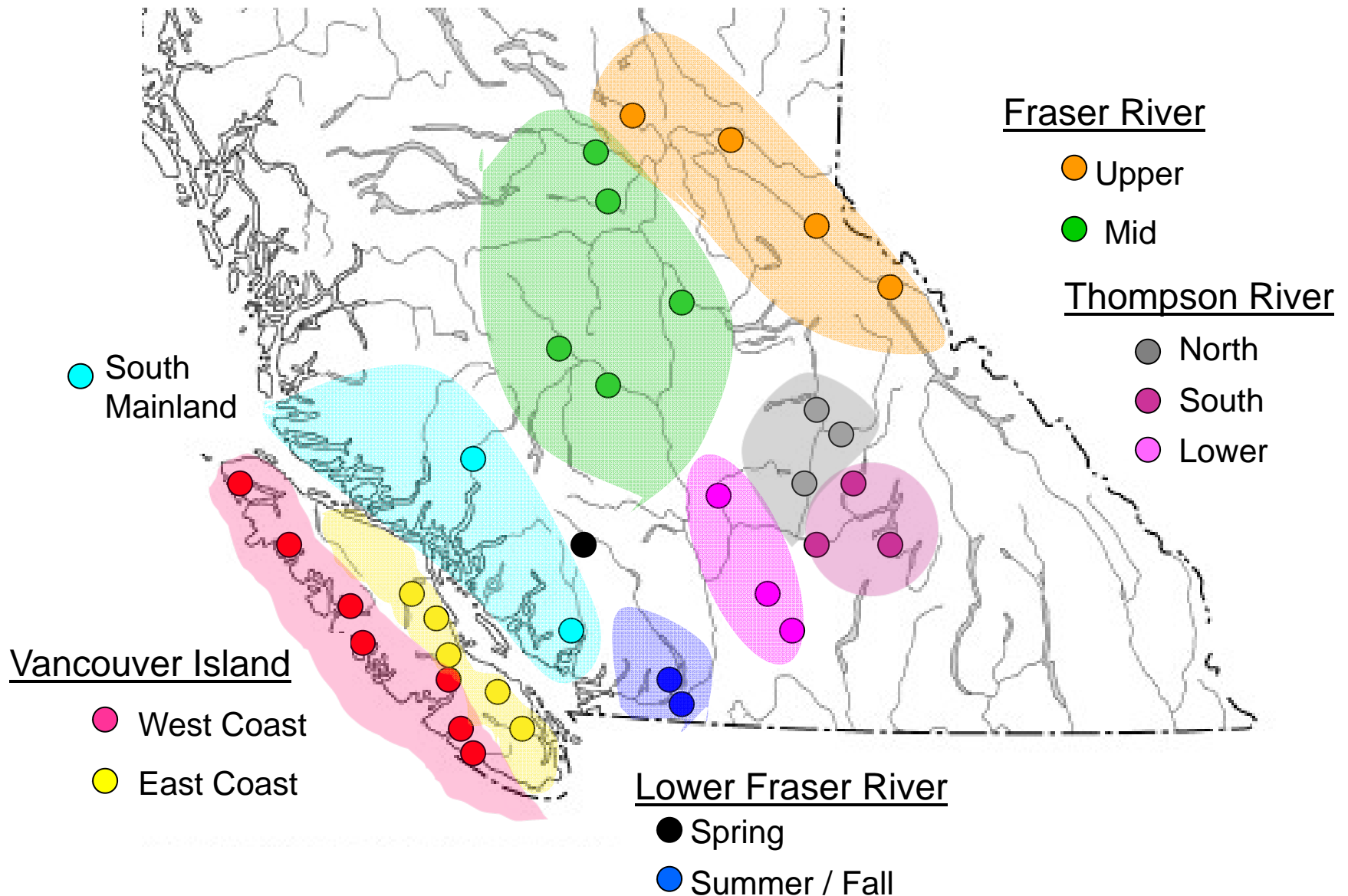
- Mixture samples: Unmarked juveniles of unknown origin caught in San Juan Island and Puget Sound marine habitats
- Baseline (reference) samples: Spawning populations in Washington and British Columbia likely to contribute to the mixed-stock sample of juveniles
- Data collection: 13 standardized (GAPS) Microsatellite DNA loci
- Analysis: Allocate and sum method using ONCOR software (Kalinowski 2007) / Ranalla & Mountain (1997) algorithm
- Stock composition estimates: Proportion of each genetic group in the mixture samples (with 95% Confidence Intervals)
- Estimates of stock origins of individual fish in mixture samples (we used only Individuals with high probability estimates - > 0.90)
 - to identify stocks that were rare in our San Juans samples
 - in a multivariate habitat and spatial analysis

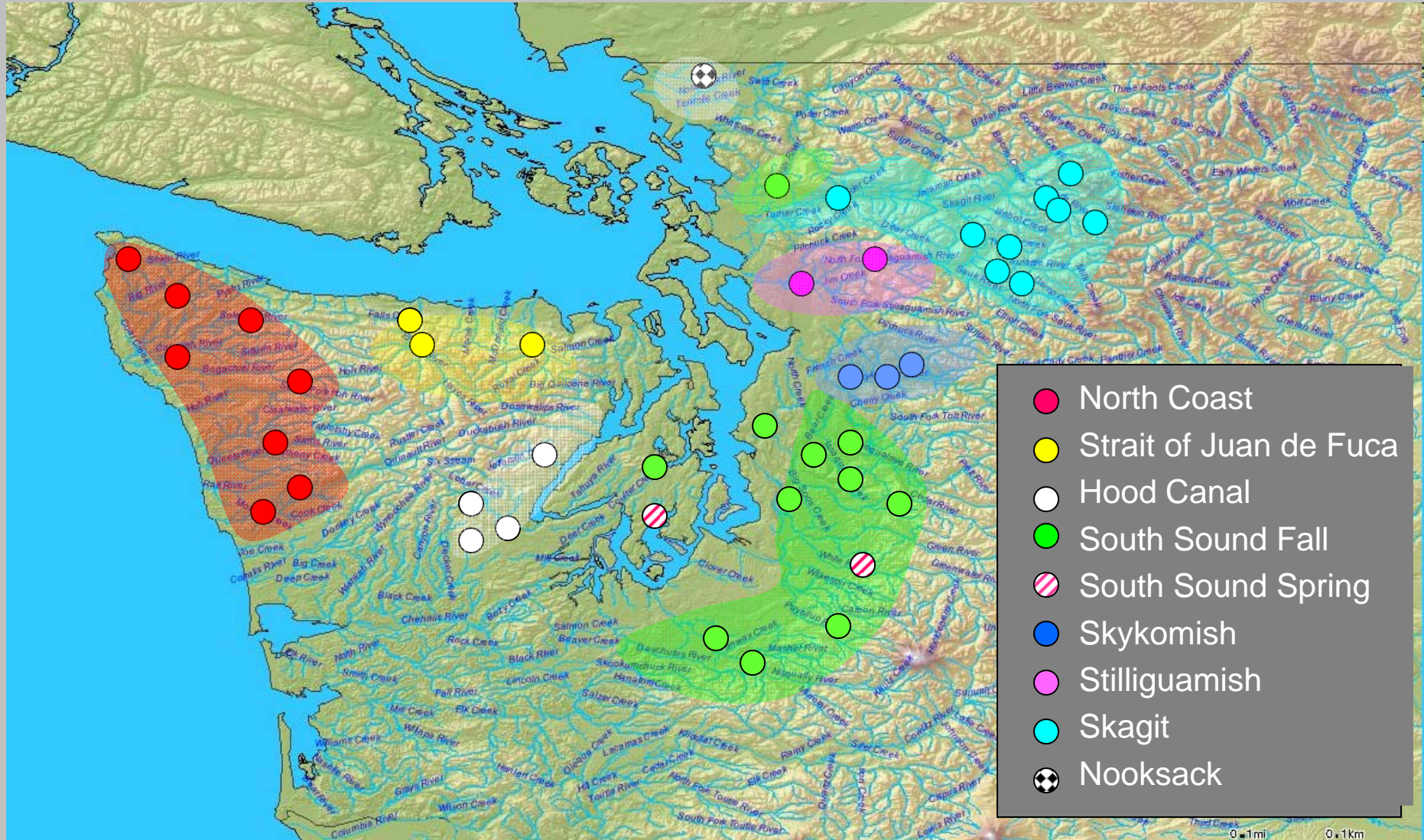
Mixture Samples were from Unmarked Fish

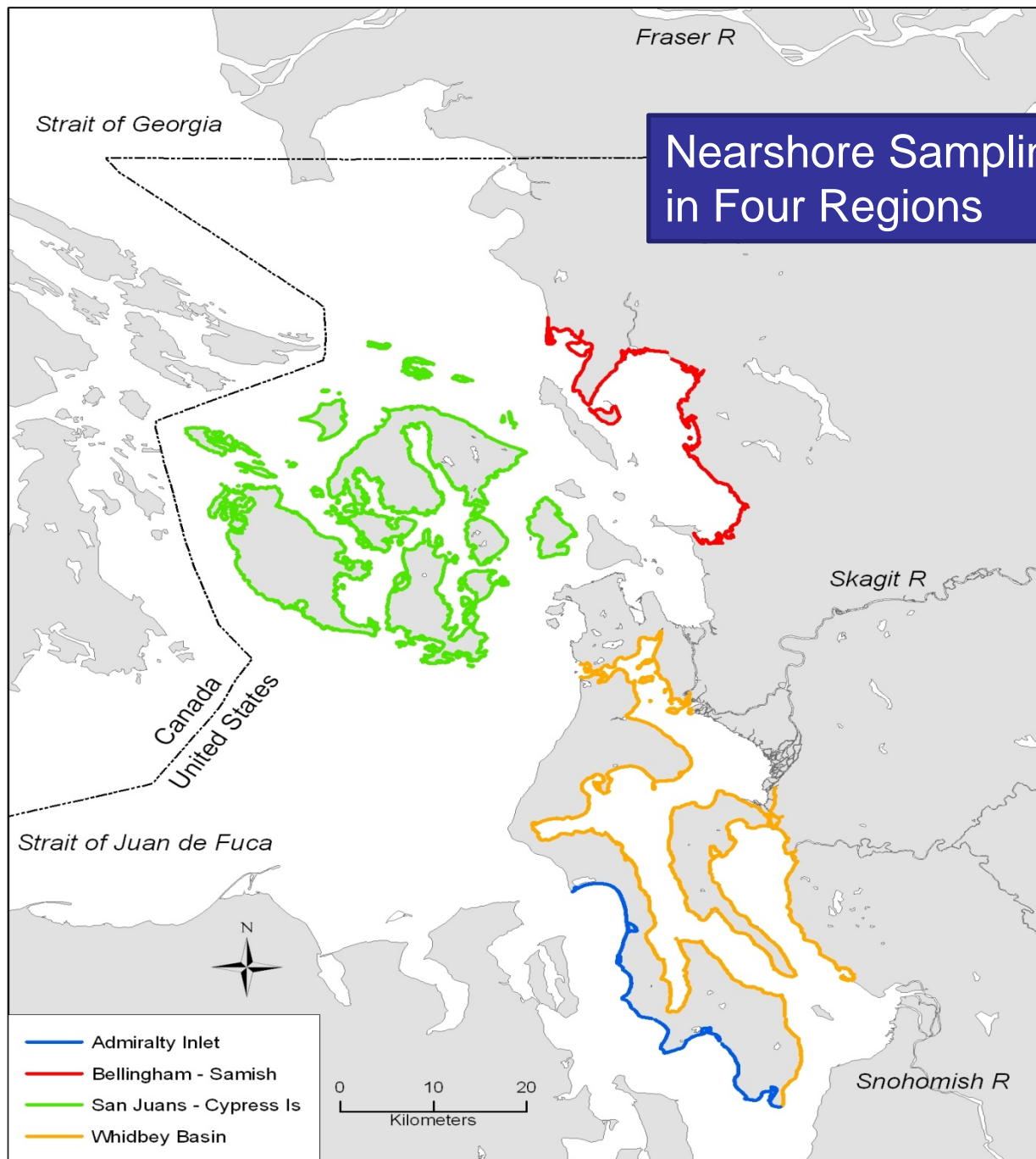
- Not all hatchery Chinook were marked during our study years so our samples likely included unmarked hatchery fish; particularly our samples of Canadian Chinook salmon.

| Unmarked Hatchery Releases | | |
|----------------------------|--------|--------|
| Puget Sound Region | 2008 | 2009 |
| No Mark | 5.2 M | 5.1 M |
| Total Release | 42.5 M | 43.2 M |
| % not marked | 12.3% | 11.8% |
| | | |
| Southern British Columbia | 2008 | 2009 |
| No Mark | 29.0 M | 30.4 M |
| Total Release | 31.2 M | 33.0 M |
| % not marked | 91.3% | 91.9% |

Genetic Groups in British Columbia







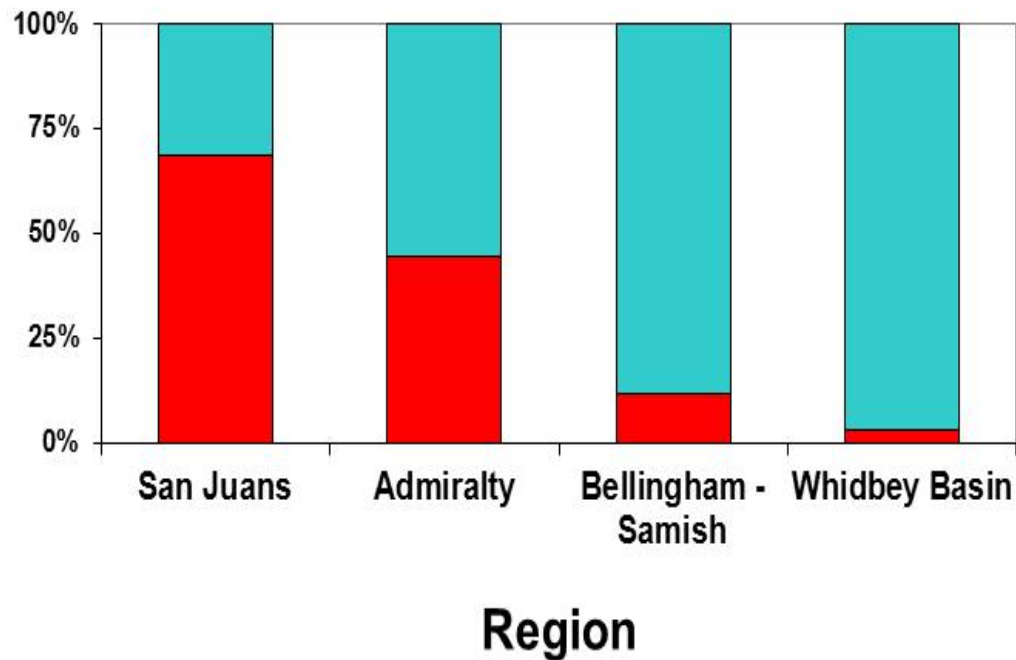
Nearshore Sampling in Four Regions

Genetic Analysis

Number of Unmarked Juvenile Chinook Salmon Samples

| Region | Offshore | Shoreline | Total |
|---------------------|----------|-----------|-------|
| San Juans | 343 | 661 | 1004 |
| Admiralty | 28 | 37 | 65 |
| Bellingham - Samish | 80 | 89 | 169 |
| Whidbey Basin | 163 | 1495 | 1658 |

Stock Proportions by Region

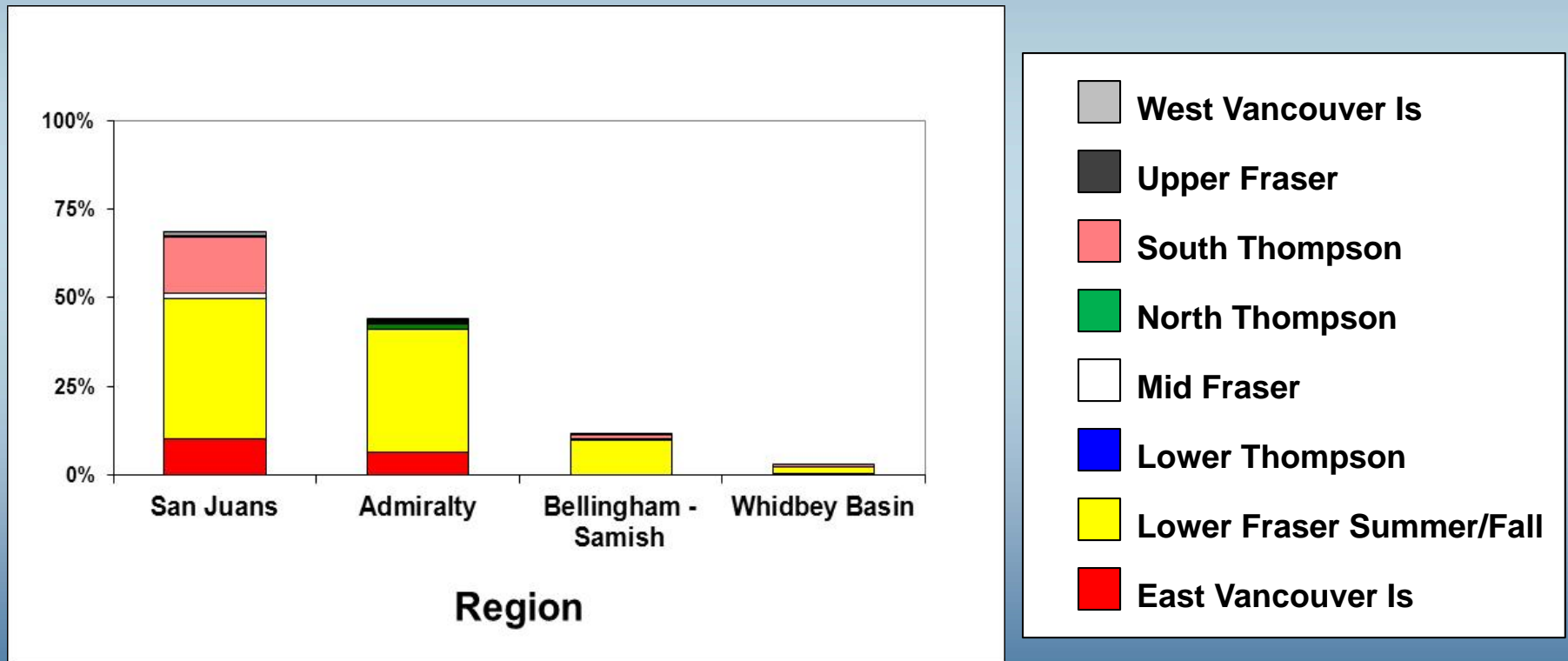


 Washington Stocks

 British Columbia Stocks

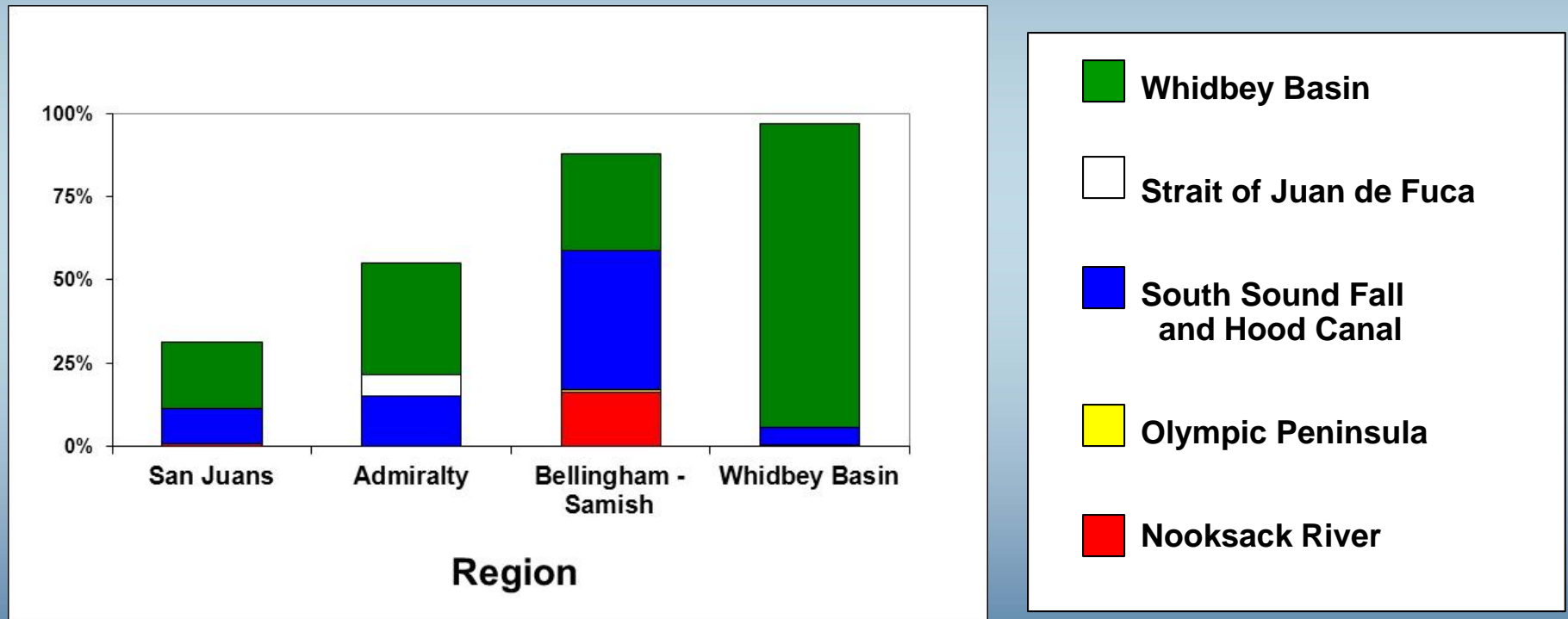
Stock Proportions by Region

British Columbia Stocks Only

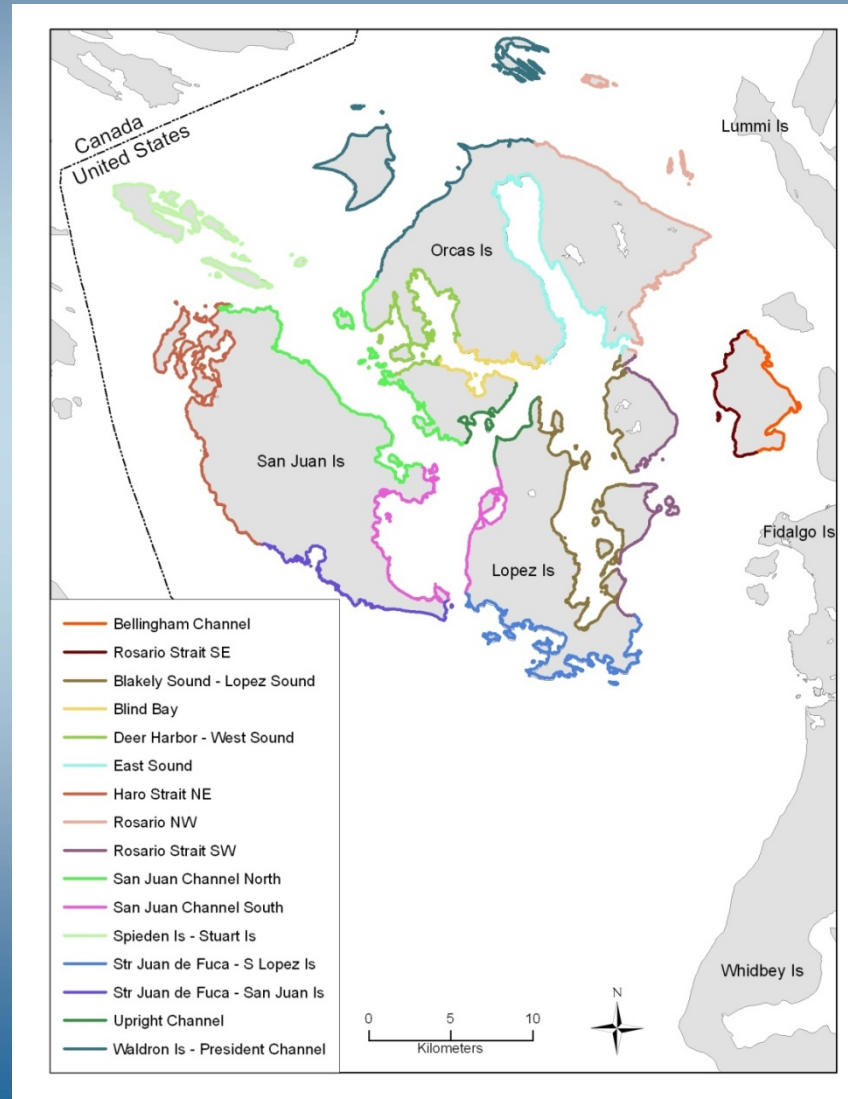


Stock Proportions by Region

Washington Stocks Only

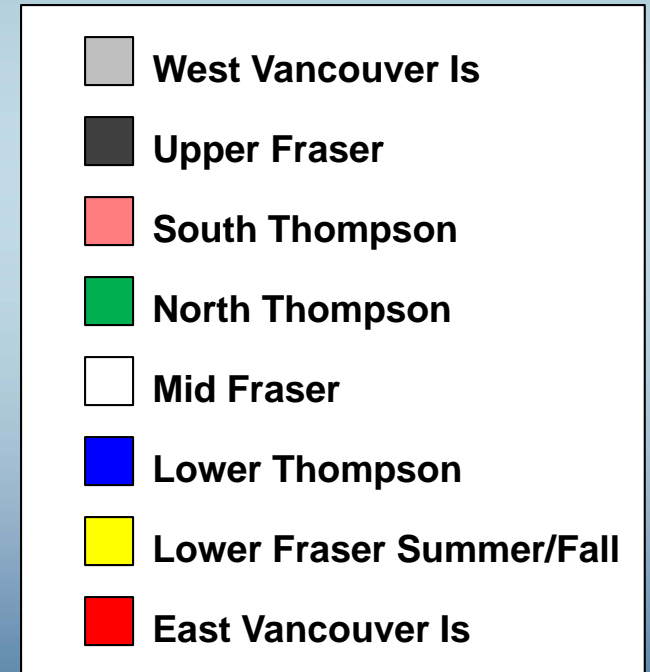
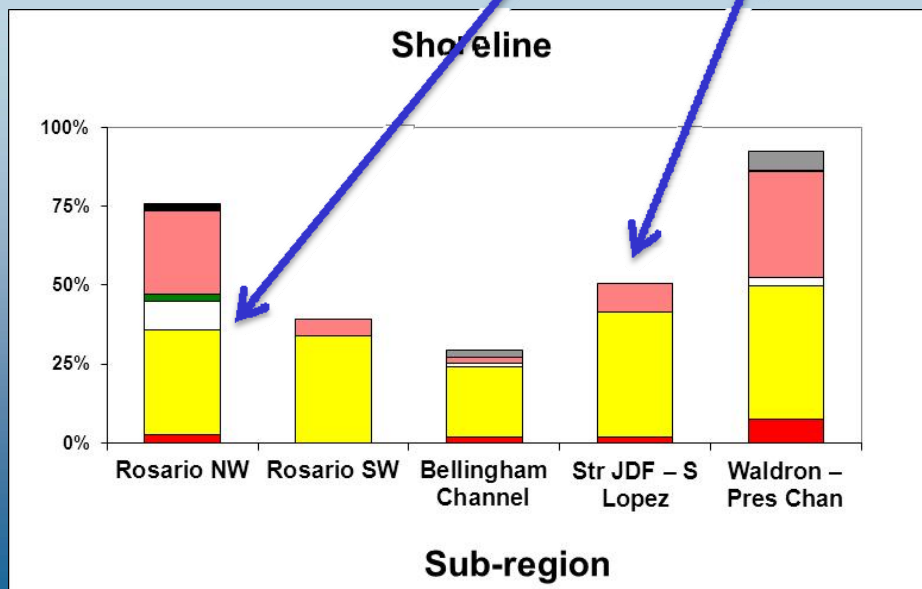
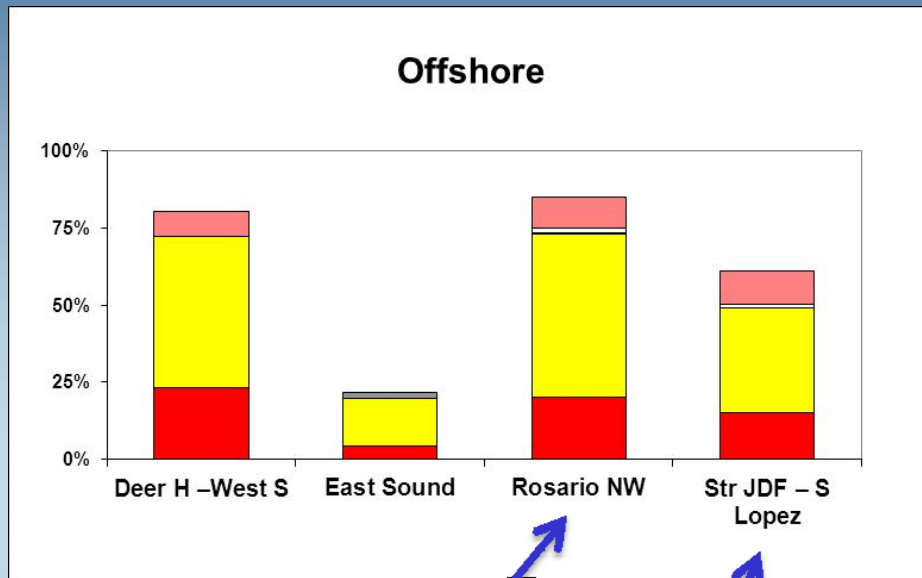


San Juans Sampling Areas



Sub-region Stock Proportions by Habitat

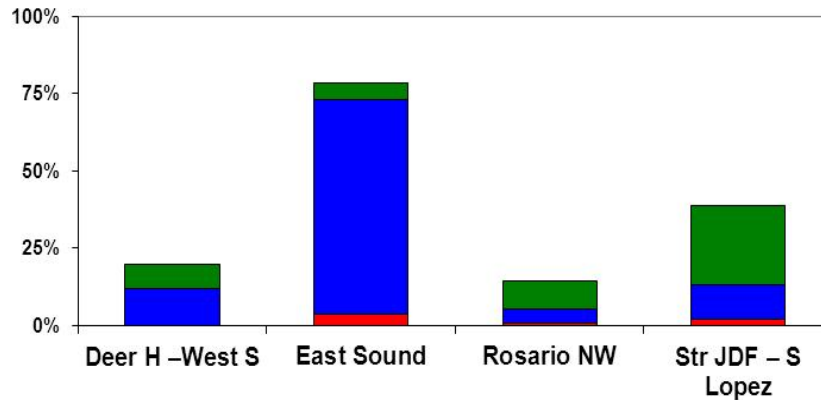
British Columbia Stocks Only



Sub-region Stock Proportions by Habitat

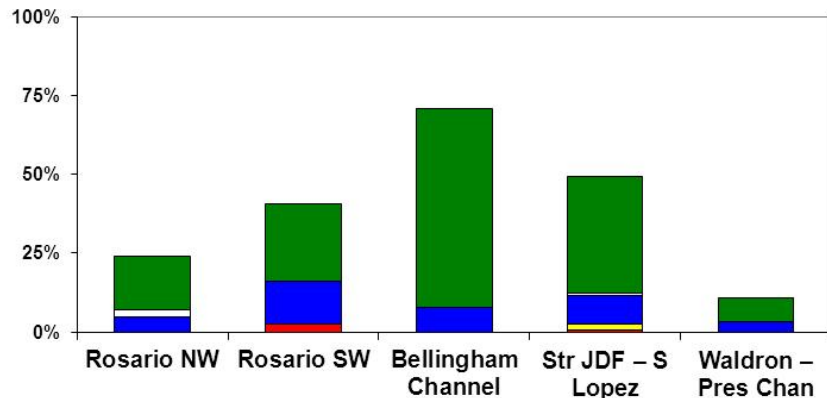
Washington Stocks Only

Offshore

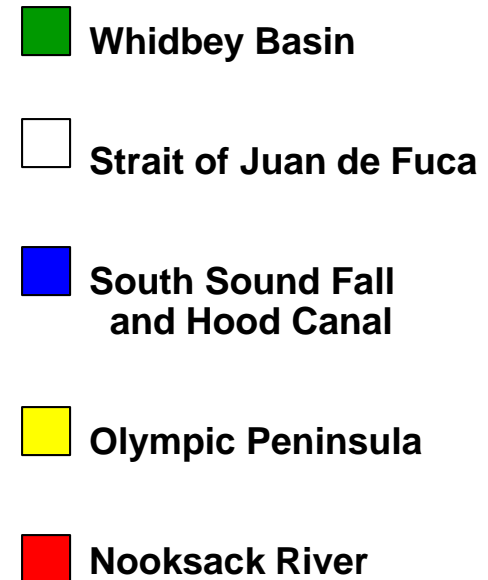


Fish identified as South Sound fall are from transplanted sources such as Samish (H or R), Nooksack R falls and Glenwood Springs Hatchery (Orcas Island).

Shoreline



Sub-region



Conclusions

- Origins of juvenile Chinook salmon in San Juan Islands nearshore marine habitats are different than in other North Puget Sound Regions
- San Juan Islands have a diverse group of stocks
- Juveniles are primarily from Fraser River, East Vancouver Island, Whidbey Basin, and Nooksack / Samish
- Very few BC hatchery fish are marked; our samples likely contain Canadian hatchery fish
- The contribution of fish from South Puget Sound sources is likely minimal
The absence of CWTs from South Sound and the legacy of stock transfers indicate that fish identified as South Sound fall are from sources such as Samish (H or R), Nooksack R falls and Glenwood Springs Hatchery

Conclusions continued

- Nooksack spring run fish (a low abundance population) were detected in our samples from eastern Sub-regions of the San Juans
- Little evidence of fish from western sources; but we identified a few from West Vancouver Island
- Several stock groups were not detected (no individuals ID'd with high probability)
Olympic Peninsula, Strait of Juan de Fuca, South Sound spring run
South BC Mainland, Lower Fraser spring run
- Origins of juvenile Chinook salmon in the San Juan Islands nearshore marine habitats are not uniform across sub-regions or habitats (offshore vs shoreline)

Acknowledgements

Collection of samples for genetic analysis

Thanks to all who contributed to the sampling effort!

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GAPS Genetic Baseline

| | |
|-------------------|-------------------|
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